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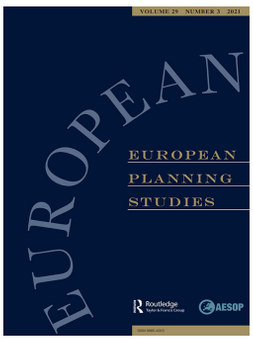

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Organizing innovation contests for public procurement of innovation – a case study of smart city hackathons in Tampere, Finland

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ABSTRACT

Public procurement of innovation is a key policy instrument for improving the quality of public services and achieving wider benefits for society. Recently, innovation contests have re-emerged as a means to procure innovative new solutions. There is, however, limited understanding of how innovation contests should be organized in the public sector. In this study, we investigate the organization of two smart city hackathon-style innovation contests in Tampere, Finland. We examine the contests' structure and goals, the definition of a problem statement, the motivation of potential participants, and their outcomes. We find that innovation contests may be used for, not only sourcing novel technologies, but also for engaging in conversations with companies, and developing an understanding of local problems and potential solutions. We further discuss the issues that arise from the integration of multiple goals in a single contest. We provide practical guidance for organizing innovation contests and evaluate their role for public procurement of innovation and local development.

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Innovation contest; public procurement; innovation; hackathon; smart city

Introduction

Public procurement of innovation has recently emerged a key innovation policy instrument (Edquist and Zabala-Iturriagagoitia 2012; Uyarra et al. 2020; Uyarra and Flanagan 2010). Via procurement, the public sector may encourage private companies to invest more in the innovation (Uyarra et al. 2014), help them cross the 'valley of death' between development and commercialization (Edler and Georghiou 2007), and facilitate the diffusion of innovative solutions (Edquist and Zabala-Iturriagagoitia 2012). Public procurement of innovation is considered to hold potential for fulfilling the procurement needs of public organizations better than existing solutions and achieving wider benefits for society (Uyarra et al. 2020).

Public procurers have recently turned their eyes on innovation contests to support public procurement of innovation. Innovation contests are an open innovation method

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where an organization posts a challenge and promises a reward to attract multiple companies to develop solutions to solve the challenge (Adamczyk, Bullinger, and Möslein 2012). In the US, public agencies such as NASA and the Defense Advanced Research Projects Agency (DARPA) have long offered *innovation inducement prizes* for incentivising the development of new technologies (Williams 2012). In the UK, the Big Green Challenge, where a contest with £1 m prize was designed to encourage and support community-led responses to climate change is a well-known example (Tjornbo and Westley 2012). Recently, innovation contests have gained more attention due to legislative changes and rapidly progressing digitization (Liotard and Revest 2018). There is a wide variety of contests that are in use in the public sector. They vary from massive competitions that last for months and have multi-million dollar prizes to small-scale hackathons that are over in a day or less.

However, there is a lack of understanding of how to organize innovation contests in the public sector. In the private sector, contests are typically targeted at well-defined (technical) problems, and it is possible to identify some best practices (Ford, Richard, and Ciuchta 2015; Gillier et al. 2018). Public sector organizations, in contrast, have more broad aims than corporations, including promoting open governance and civic engagement and supporting the emergence of innovative businesses and economic development in their respective regions (Bleda and Chicot 2020; Carr and Lassiter 2017; Hartmann, Mainka, and Stock 2016; Johnson and Robinson 2014; Mergel and Desouza 2013; Sotarauta 2009). In making decisions on innovation contest design, various trade-offs need to be considered (Dahlander, Jeppesen, and Piezunka 2019), and, in the public sector, the integration of priorities from various policy areas creates additional trade-offs that need to be balanced, generating a complex managerial challenge between strategic leadership and operational environment (Sotarauta 2005; Sotarauta and Mustikkamäki 2012). Procurers often lack skills and experience in procuring for innovations in general (Georghiou et al. 2014; Obwegeser and Müller 2018), especially when it comes to innovation contests (Carr and Lassiter 2017). Unfortunately, few studies address their organization, apart from reports of well-known ambitious innovation contests (Adler 2011; Kay 2012; Mergel and Desouza 2013; Stine 2009), such as the Ansari X-prize contest organized by NASA. However, such examples are relevant for only a few because of their massive size and resource needs. In sum, despite the recent attention to innovation contests as an innovation policy tool, there is a lack of understanding of organizing them. This is the research gap that this study aims to address.

We adopt a case study research design to investigate two smart city hackathon-style innovation contests organized by the city of Tampere, Finland. We identify key dimensions of organizing contests from a literature review of public sector innovation contests. These include decisions related to several key questions, such as the hackathon type, definition of the problem statement, and ways to motivate the participants. We argue that these decisions influence the extent to which a hackathon's outcomes may fulfil the organizers' aims. We then conduct an in-depth investigation of our case contests and examine the aims, implementation, and outcomes of the hackathons. In specific, we seek answers to the following research question.

RQ: How should a city organize innovation contests for the public procurement of innovation?

Theoretical framework

Public procurement of innovation

The goal of public procurement has traditionally been efficiency: obtaining desired goods or services at the lowest price. Recently, the potential of public procurement as an innovation policy tool has received attention (Edquist and Zabala-Iturriagagoitia 2012; Uyarra et al. 2020). Traditional public procurement typically targets ready-made products and services. In contrast, when public organizations engage in public procurement of innovation, they place orders to fulfil specific needs and expect companies to address them by offering innovative solutions (Edquist, Vonortas, and Zabala-Iturriagagoitia 2015). The primary goal of public procurement of innovation is ensuring the quality of public services by gaining access to the best available products and services (Uyarra and Flanagan 2010). Also, there may be secondary goals linked with broader policy objectives, such as promoting the growth of innovative companies.

By creating demand for innovative solutions, public organizations may stimulate private sector innovation. Public organizations, such as local city governments, may facilitate innovation activities in their region and beyond and innovate new solutions for the local city government needs in collaboration with the private sector (Makkonen, Merisalo, and Inkinen 2018). They may also act as a lead user for novel products and services by being the first customer to buy and apply them. As a lead user, the government takes the risk of working with technologies that may not be fully optimized yet in exchange for achieving desired solutions to identified problems more quickly and providing valuable references for companies (Edler and Georghiou 2007). Procurement processes also provide opportunities for socially and spatially embedded 'conversations' that facilitate knowledge exchange and collective learning that promote innovation by helping different actors understand their individual needs and available resources and create shared future visions (Lester and Piore 2004; Rutten 2017; Uyarra et al. 2017; van Winden and Carvalho 2019). Besides economic goals, public procurement of innovation is often associated with promoting social and environmental objectives (Lember, Kalvet, and Kattel 2011). Public organizations may, for example, aim to achieve their carbon neutrality goals through the procurement of innovative clean technologies (Alhola and Nissinen 2018). In the recent discussions on transformative and mission-oriented innovation policy (Mazzucato 2018; Schot and Steinmueller 2018), public procurement of innovation is considered a critical method for responding to grand challenges such as climate change and ageing (Edquist and Zabala-Iturriagagoitia 2012; Uyarra et al. 2020).

Different types of public procurement of innovation have been identified. Researchers and practitioners widely use a distinction between pre-commercial procurement (PCP) and public procurement of innovative solutions (PPI). PCP concerns the phase before commercialization, where further R&D is needed before a solution may be used (Edquist and Zabala-Iturriagagoitia 2015). When engaging in PCP, a public organization provides funding to a company to develop a concept, prototype or a demonstration of a new solution. PCP does not automatically lead to the procurement of the developed solution. However, it decreases the level of risk associated with innovation and may lead to the generation of solutions that would otherwise have not realized. In contrast, PPI facilitates the wide diffusion of innovative solutions on the market by providing 'a large

enough demand to incentivise industry to invest in wide commercialization to bring innovative solutions to the market with the quality and price needed for mass-market deployment' (European Commission 2018).

The broad acknowledgement of the benefits of public procurement of innovation has encouraged public organizations to seek novel procurement methods that help achieve them. Since 2016, the public procurement rules in the European Union have allowed a new procurement procedure – innovation partnership – that combines the development of a new solution and the purchase of the developed solution in a single procurement (Directive 2014/24/EU (49)). Public-Private Partnerships (PPPs), where public sector bodies enter into long-term contractual agreements with private companies have been found valuable in stimulating innovation in the infrastructure construction sector (Carbonara and Pellegrino 2018). Finally, public agencies have adopted open innovation tools and methods, such as co-creation workshops, crowdsourcing, and stakeholder engagement, to foster interactions with the private sector (Liotard and Revest 2018; Timmermans and Zabala-Iturriagagoitia 2013; Torvinen and Ulkuniemi 2016).

Innovation contests as a policy instrument

Innovation contests are an open innovation method currently experiencing a sort of renaissance within innovation policy. Different prizes and contests have been in use for hundreds of years to stimulate innovation (Scotchmer 2004). However, only recently have they been studied as policy tools (Liotard and Revest 2018). In an innovation contest, an organization posts a challenge and promises a reward to attract multiple participants to develop solutions to solve the challenge (Adamczyk, Bullinger, and Möslein 2012). Innovation contests can be considered a form of crowdsourcing, where a task is outsourced to an undefined network of people or organizations in the form of an open call (Howe 2008).

The increased attention on innovation contests can be explained by legislative changes and rapidly progressing digitization (Liotard and Revest 2018). In 2010, the America COMPETES Act was adopted in the US that allows public agencies to conduct prize competitions. After this legislative change, innovation contests have been applied in solving hundreds of problems related to topics ranging from health care and education to environment and national security (Desouza 2012). European Commission has also promoted open data competitions to foster the development of new information services (European Commission 2011). Whether they focus on commercialization or the stimulation of new ideas, innovation contests may include elements of either of the PCP and PPI types of public procurement of innovation (Liotard and Revest 2018).

There is a wide variety of contests that are in use in the public sector. Smaller contests often take the form of hackathons, that is events that bring together participants (often programmers) to work intensively over a short time to solve a problem (Briscoe and Mulligan 2014). Smart cities have been identified as an area where innovation contests have particularly significant potential. The concept of smart cities refers to urban areas where information and communications technology is used to improve its operations (Caragliu, Del Bo, and Nijkamp 2011). By collecting and using data from various sources, it becomes possible to generate improvements both in the 'hard domain', such as buildings, energy grids, natural resources, water management, waste management, mobility, and

logistics and in the 'soft domain', such as education, culture, policy innovations, social inclusion, and government (Albino, Berardi, and Dangelico 2015). Access to big data, which may be sensor-based or user-generated, provides ample opportunities for service development. Many cities use innovation contests to find ways to identify and benefit from these opportunities (Hartmann, Mainka, and Stock 2016; Johnson and Robinson 2014).

Organizing innovation contests

As public organizations have adopted public procurement of innovation in their policy repertoire and started to use methods such as hackathons, concerns have been raised about their capability to carry such activities out successfully. Innovative companies face numerous barriers related to processes, competencies, procedures, and relationships that prevent the generation of innovations in public procurement (Uyarra et al. 2014). In terms of the stimulation of private R&D effort, many innovation contests may be considered successful. Whether that effort is transformed into valuable innovations is not so clear. Many of the services that they generate are already available in more mature forms from the market (Carr and Lassiter 2017). Johnson and Robinson (2014) argue that more research is needed to conclude whether innovation contests are useful in generating long-term impacts or whether they are mere 'stunts' to create short-term buzz. Some authors, however, argue that a broader perspective on the benefits from innovation contests should be adopted. In addition to acquiring new solutions, contests may enable the creation of new public resources (e.g. new data repositories), increase awareness of social issues, facilitate learning on public procurement of innovation, or establish new partnerships in the public sphere (Mergel and Desouza 2013; van Winden and Carvalho 2019). They may also provide a stimulus for new companies and job creation and orient consumers toward defined markets (Liotard and Revest 2018).

Nevertheless, concerns over the effectiveness of innovation contests should not be disregarded. Innovative procurement activities are complex, and their management requires expertise beyond procurers' traditional domain (Obwegeser and Müller 2018). Innovation contests are inherently an open-ended and risky activity that requires strategic leadership (Sotarauta and Mustikkamäki 2012). However, procurers often lack skills and experience in procuring for innovations, resulting in high costs or modest outcomes (Georghiou et al. 2014). Carr and Lassiter (2017) argue that despite a high degree of enthusiasm for innovation contests, the results remain modest due to a lack of professionalism in organizing them. According to them, more understanding of best practices in organizing innovation contests is needed before becoming a useful policy tool.

The extant literature on public sector innovation contests suggests different contest design elements that organizers need to acknowledge. A key to organizing a successful innovation contest is aligning the design elements with the contest's goals. Therefore, organizations need the ability to align the organization's strategic goals with more specific project goals (Sotarauta 2009). While more detailed lists of relevant design elements are available (Adamczyk, Bullinger, and Möslein 2012), the main aspects can be summarized in three points: structure, problem statement, and participant motivation.

An innovation contest's **structure** concerns the overall set-up regarding its size, timespan, process phases, and practical arrangements (e.g. face-to-face vs online). Innovation

contests may take many forms ranging from online idea platforms that require little commitment from the participants to intensive long-term development endeavours. Depending on the chosen format, contests may vary in length, the intensity of interactions, and the number of involved stakeholders (Liotard and Revest 2018). Crowdsourcing platforms, which are often provided by private companies such as Innocentive or NineSigma, may be used to attract numerous solvers with little interactions (Davis, Richard, and Keeton 2015). However, they may remain too detached from the public sector organization and its goals (Blohm et al. 2018). Hackathons typically comprise a 1–3-day event at a determined location, whereas more massive app competitions may last for several months before a solution is submitted (Hartmann, Mainka, and Stock 2016). Large competitions may attract more participants and lead to better solutions, but they are arduous to manage (Desouza 2012). On the other hand, smaller competitions may be unable to tackle large and complex challenges (van Winden and Carvalho 2019). Contests also vary in the number of phases. Sometimes multiple rounds are used to raise the elaborateness of the submissions in each phase (Adamczyk, Bullinger, and Möslein 2012), and each development phase is followed by an elimination round that only the most promising solutions survive (Terwiesch and Ulrich 2009). Multi-phase contests allow organizers to invest in the most promising solutions, but they come with increased bureaucracy and longer procurement processes (van Winden and Carvalho 2019). This variety of contest structures makes innovation contests a versatile tool for acquiring new ideas and solutions, but at the same time requires careful consideration from the organizers: a suitable contest type needs to be decided for the specific problem at hand.

In innovation contests, defining a **problem statement** is the leading way for guiding the participants in developing needed solutions. With a clear problem statement, a public organization's need is crystallised in a condensed and accessible format. Hartmann, Mainka, and Stock (2016) note that the scope of innovation contests varies greatly from broad themes, such as mobility, to specific solutions and tools for APIs. The more 'difficult, intractable or wicked' the problem is, the more complex and challenging this process of demand articulation becomes (Uyarra et al. 2020, 3). Carr and Lassiter (2017) suggest that it is complicated for outsiders to understand the context of the problem in a short time and produce meaningful and valuable solutions. Hence, the organizers need to provide a clear description of their problem (Adamczyk, Bullinger, and Möslein 2012). To help in this, Spradlin (2012) proposes that organizations should first clarify the need for a solution internally, articulate why it is essential, research how others have already tried to solve the problem, and finally create a clear and complete description of the previous points for the participants. The problem statement functions as a basis on top of which other contest guidelines and materials can be produced. The organizers also need to specify with what kind of solutions the solution providers are eligible to participate, how the solutions will be evaluated, and the practical context that the problem is embedded in (Mergel and Desouza 2013).

A critical task in organizing innovation contests is deciding who is eligible or wanted to participate (Liotard and Revest 2018). This enables the organizers to think of appropriate incentives for them; in other words, how to **motivate the participants**. The most visible motivational factor in innovation contests is usually a monetary prize for the winner solution. The prize sums are typically defined in advance, but the payment size can also be proportional to the measured impact of the winning solutions (Masters

and Delbecq 2008). In many cases, non-monetary rewards may, however, have a significant role in attracting participants. The contests may offer the opportunity to increase knowledge and personal skills, network with public sector organizations and other developers, gain reputation, visibility, and credibility that may be beneficial for seizing future commercial opportunities (Liotard and Revest 2018; Mergel and Desouza 2013; van Winden and Carvalho 2019). Mergel and Desouza (2013) emphasize that a good understanding of the desired participants' expectations and social and economic realities is needed to choose the right kind of incentives. This notion, however, presumes that potential participants have already been identified. The core logic of innovation contests relies on some degree of open-endedness: instead of asking known companies to submit a proposal, the challenge is broadcasted to more or less undefined audiences. If the contest is targeted to a pre-defined group, motivating the participants is easier, but the solutions' diversity and innovativeness may suffer (Dahlander, Jeppesen, and Piezunka 2019). In contrast, motivating people without understanding who they may be is difficult as their motivation and goals may differ. Almirall, Lee, and Majchrzak (2014) find that, when using hackathons, cities should engage with established hacker communities. This relieves them from attracting contributors and makes their primary role to provide open datasets for the contestants. Cities should, however, be aware that participants from hacker communities may operate under a different logic than companies, and the two groups are unlikely to respond to similar motivating efforts (O'Mahony and Bechky 2008).

Methodology

We chose the city of Tampere, Finland, for our case organization based on it having a high strategic priority on and experience of public procurement of innovation. Based on discussion with city representatives, we identified two recent smart city hackathons. The hackathons shared a theme, both relating to ongoing smart city development projects, including an EU-funded STARDUST smart city project, but differed in the actual implementation. Investigating two hackathon processes allows us to deepen our inquiry by paying attention to their differences while controlling some variation that could arise from differences in the subject matter.

The data set for the study comprises documents and interviews. The city had prepared two detailed 20-page reports of the two procurement processes that provided a sound basis for getting to know the cases (Vehviläinen 2019; Vilhula and Vehviläinen 2020). Further documents such as presentations, procurement documents, and news articles were collected to complement the report. Moreover, we interviewed five key people who contributed to the planning and implementation of the hackathons at Tampere and three hackathon participants. The documents include information about the hackathon processes and their outcomes, and the interviews focused on normative evaluations and experiences of them. A semi-structured interview guide was used in all of the interviews. The guide included following themes: background and aims for the hackathon, process of the problem statement and ways to motivate the participants, implementation of the hackathons, a reflection of the hackathons' success, and critical decisions. Same themes were discussed with the hackathon participants from their perspectives (e.g. background and aims of the company to participate,

and the problem statement from the company perspective). All interviews were then recorded and transcribed verbatim.

The analysis process was structured by the critical organizing categories identified based on extant research. Relevant material from the documents and interview transcripts were summarized into a reduced form. By organizing the material into cross-case matrixes, similarities and differences between the two studied cases could be identified (Miles, Huberman, and Saldaña 2014). Key insights are summarized in Table 1.

Results

Background and structure of the hackathons

We explored two different hackathons called *Enlighten Tampere* and *Junction*, whose processes are depicted in Figure 1. The first hackathon, *Enlighten Tampere,* was organized in June 2018 by the city itself in cooperation with an external facilitator. The challenge of Enlighten Tampere was announced in the national public procurement announcement platform *HILMA* and on the facilitator's website. Twenty-four companies applied to the hackathon and six teams were selected. Before the actual hackathon, an introductory event was organized where information about the challenge and available resources and mentors were disseminated. The teams started working on their solutions already before the actual hackathon event, i.e. a two-day co-development camp. The

Table 1. A summary of the cases.

	Enlighten Tampere	Junction
Goals	Project goals; city-level strategic goals (including innovation policy-related goals); P&R, visibility, and communication goals; capability building.	
Structure	Introductory event and two-day camp. National innovation partnership procedure adapted to EU procurement rules. Self-organized event (with a facilitator) by three smart city development projects. Six companies (out of 24) were invited to participate as a result of bidding competition.	Competitive negotiation procedure. A big annual two-day hackathon event with thousands of participants, organized by a third party. The city participated with two challenges that were announced in the event. The third party selected the initial participants, and city project officers chose the best solutions.
Problem statement	Technology-driven challenge. Co-designed with three EU-funded development projects, the Smart City development programme, public procurement experts of the city, and the hackathon facilitator. One openly defined challenge. Problem statement did not derive from a clearly defined problem but a mixture of goals and actors.	Problem-driven challenge. Co-designed with three EU-funded development projects, the Smart City development programme, the city's public procurement experts, and other city representatives. Two openly defined challenges. Problem statements did not derive from a clearly defined problem but a mixture of goals and actors.
Motivating the participants	Possibility for a public procurement contract. A reward of 1500 euros for each team selected to participate in the pilot phase. The chosen participants received additional compensation of 10 000 – 30 000 euros for their work during the pilot phase.	Possibility for a public procurement contract. No reward for taking part in the contest (a reward of 1500 euros for the selected winners). Interacting with the participants in the event was deemed critical as there was no prior interaction.
Outcomes	All six participants left proposals. The city selected three winners to continue the development and form a joint solution in three separate pilots. One of the solutions generated subsequent innovation.	Three winners were selected. The process stopped after the hackathon because none of the solutions originated from an established company.

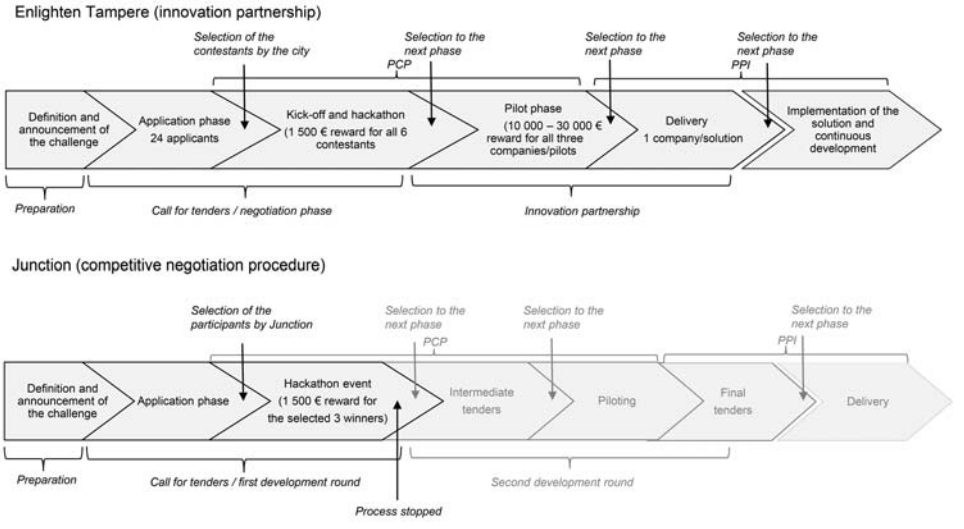

Figure 1. Two hackathon processes organized by the city of Tampere. Modified from Vehviläinen (2019).

second hackathon, *Junction*, is a big yearly technology event that gathers over 1 000 international participants every year. The two-day event is organized by a volunteer-based non-profit organization, Startup Foundation, which promotes the Nordic startup ecosystems.

Both hackathons were joint actions by multiple city initiatives: three EU-funded research and development projects and a *Smart Tampere* development programme. The projects implemented new methods for supporting the city's transformation to a smart, efficient, and citizen-orientated organization, and to create an opportunity for startups to develop new services and get customer references (Vehviläinen 2019). Finding innovative solutions was one of the main goals for the hackathons as the following quote shows:

> We wanted to see what kinds of innovative services or solutions can be found from the market. That is the main goal in the public procurement of innovation that the buyer knows the need but not the best solution. Markets or companies are the best to tell how the need could be solved and what are the new technologies to be used. This was our main point that the city does not know all the opportunities from the market, and this pushed us to find solutions through the contest and the challenge.

Besides the project's goals, the hackathons also advanced city-level strategic goals. Tampere's city strategy states that innovative and effective procurement policies should be implemented to increase productivity, develop services, create new business opportunities, and promote innovation and growth. The interviewees stated that the city's innovation policy goals and the desire to develop public procurement of innovation practices formed the hackathons' background. Both hackathons had also goals related to communication, P&R, and visibility. The interviewees mentioned a willingness to create a hackathon culture in Tampere and to build a city brand to show that Tampere is at the forefront of advancing cooperation with smaller companies:

> Also, the communicative side [was important]. We want to show outside that the city also procures by these methods. We wanted to show that the city can be an interesting partner also for smaller companies.

Despite shared goals, the hackathons used different procurement procedures to strengthen the city organization's capabilities in public procurement of innovation. *Enlighten Tampere* used the national innovation partnership procedure that was adapted to EU procurement rules. *Junction* used the competitive negotiation procedure that was planned to contain pilots and a commercial phase.

> This was an opportunity to do [procurement] in a different way. A key motivation for the city was to learn different methods and how to implement those. Thus, to educate your organisation and to learn [were important goals].

The hackathons differed in how the organizers interacted with the participants. Interactions were considered essential for informing participants of the city's needs and gaining an in-depth understanding of the proposed solutions. Enlighten Tampere had more interactions, whereas, in Junction, they were hindered by a tight schedule and a lack of suitable space:

> We had not enough time for the selection. The event space was big, and the teams were spread out all over the big space. It took time to find where the teams situated. The space was noisy, and it was difficult to hear. Also, our group of judges was big, and we needed to make compromises. None of the solutions ended up to a pilot.

For the interactions to be productive, the right people needed to be involved. The interviewees emphasized that in Junction, where there were no interactions with the participants before the event, experienced city personnel would have been needed to inform the participants about what solutions were already known to the city:

> In Junction, we did not get mentors from the city organisation [to participate in the event]. All, or at least majority, of our employees in the event, were project officers. This led to the situation that the solutions we selected were not new for the city.

Problem statements of the hackathons

The hackathons' problem statements were co-designed with the three EU-funded projects, the Smart City development programme, public procurement experts of the city, and the hackathon facilitator in Enlighten Tampere. The projects decided to join forces to create more prominent hackathons than what would have been possible if the different projects worked separately. In *Enlighten Tampere,* the challenge addressed new data-driven applications and experiments. The city's street lighting system was adopted as a starting point. The challenge had two themes: 'Enabling a smarter city with data science' and 'Designing data-enabled services for the citizens'. *Junction's* two challenges, 'New solutions of mobility' and 'New solutions of guidance', did not have connections to specific technologies.

In both hackathons, the problem statements were relatively openly defined. The interviewees described that the problem statements' design processes did not derive from a clearly defined problem but a mixture of goals and actors. The processes were described difficult:

> It was very, very difficult [to form the problem statement]. Both contests derived from broad goals, and there were no clearly defined problems to be solved. Thus, how to form a clear statement of what we want, it was yes [difficult], we had many workshops to design what we are after.

Whereas in Enlighten Tampere, the problem statement derived mostly from the projects' goals, in Junction, more city representatives were included in designing the problem statement to ensure that the new solutions would have an owner in the city organization after the piloting phase. The interviewees argued that having an owner from the city, rather than from the projects, would facilitate the solutions' adoption:

> The reason why we included more people to design the problem statement for Junction was that during Enlighten Tampere we noticed that if we do this in a very project-oriented manner but aim to generate new services that would be used for a long time, we need to have owners for the solutions from the city organisations and that they need to be involved already when formulating the problem statement in order to commit them to the process. Thus, [I now see that] the challenge definitions should come from the owners [of the possible new solutions] from the city organisation whereas the projects should have more financial role in development and testing phase.

Hackathon participants, who won Enlighten Tampere, provided us with an interesting developer-side insight considering the definition of a problem statement. From their perspective, the problem was mainly technology-driven instead of problem-driven. Instead of an exact problem to be solved, the city provided technology and data that they hoped to lead to innovations. Thus, in a way, the participants also had a role in defining the problem statement since they had also to identify a specific problem to justify their solution. The findings suggest that an open definition leaves more space to innovate but is also more arduous for the participants. Broad problem statements can also be perceived as a sign of weak commitment by the city into the developed solutions, which may concern the participants. Furthermore, an ambiguous problem statement demands discussion between developers and the city in the hackathon and during the development process.

Motivating the participants

The city published procurement announcements for both hackathons in national public procurement platform HILMA to raise awareness. In Enlighten Tampere, the city also relied on the hackathon facilitator's networks and marketing in finding suitable companies. The primary means for motivating the participants was a public procurement of innovation contract that the winner(s) would be offered after the contest. Each team selected to participate in the pilot phase received a reward of 1500 euros and additional compensation of 10 000–30 000 euros for their work during the phase.

In Junction, the city representatives competed for participants' attention with other organizations, including major corporations. In the event, participants had an opportunity to discuss with different organizations and choose which challenge they start working. Thus, motivating the participants in the event was important. For both hackathons, the city decided that the participants selected for further collaboration need to be companies. However, in Junction, most of the participants were domestic and international students who did not have a company, or a possibility to start a company in

Finland. One interviewee assumed the large companies' challenges were more attractive for the students because they provided them with an opportunity to show their skills for potential future employees. Presumably, these reasons discouraged some participants from starting working on Tampere's challenge. This issue arose from a poor understanding of the targeted participants:

> In Junction, we needed to find a company as a partner, but we did not understand beforehand that there would be that many students. We thought that if we make the precondition that the selected partner needs to be a company, the challenge will motivate especially companies. Also, because the pilot phase was our reward, we thought our challenge would primarily interest companies. However, in the event, and after it, when we received statistics, we understood that only a minority of the participants were companies.

To complement the city representatives' views, we also asked from the winners of Enlighten Tampere about their motivation to participate in the hackathon. They emphasized that the hackathons, in general, provide possibilities to network and discuss with clients and that they provide important and rare opportunities for a small company to innovate. Acquiring customers, also beyond the hackathon's scope, was one of the primary motivations to participate. Participation provided an excellent opportunity to show their skills and innovation expertise for a big organization, such as the city of Tampere, which is an untypical client for them.

Outcomes of the hackathons and key success factors

In Junction, the city received many good ideas and rewarded three winners with 1500 euros: two for the mobility challenge and one for the guidance challenge. However, the process stopped after the hackathon because none of the solutions originated from an established company. Thus, the contest's outcomes were restricted mainly to gaining visibility and a positive reputation as experimental city organization, developing a 'hackathon culture' in the city, and capability building for innovation contests and public procurement for innovation. This outcome also raised thoughts of an alternate method of first buying the intellectual property rights to an idea, and later finding a company to implement it.

Enlighten Tampere was successful in filling its goals. All six participants left proposals. The city selected three winners to continue developing and forming a joint solution in three separate pilots focused on mobility, modelling sunlight, and an intelligent light system. One of the solutions also generated subsequent innovation through continuous development. The city's mobile application *Tampere.Finland* that was initially planned to gather mobility data for a smart lighting system has later been developed to an extensive city service platform for Tampere residents. This procurement contract is, at the time of writing, continuing having found an owner from the city organization.

The interviewees reflected the hackathons' goals and outcomes and the success factors and challenges in the process. The process enhanced the city's capability-building to conduct public procurement of innovation and use hackathons for stimulating innovation. Critical points to consider are partly practical, such as ensuring that the hackathons are organized professionally as they influence the perceptions of the city. Also, a hackathon's nature is critical to match the organization's goals to find contestants with suitable profiles for the task. Motivating participants, e.g. monetary rewards, is also

essential to consider concerning companies' desired population. Moreover, the findings suggest that formulating a problem statement is one of the most critical factors because it translates the organization's goals and needs to the participants and has a considerable impact on attracting suitable solutions. The problem formulation process demands considerable time and effort from multiple actors from the city. Especially those who would be long-term owners of the procured solution in the organization should be involved.

Discussion

It has been previously noted that innovation contests 'can supply diverse organizational architectures or designs' (Liotard and Revest 2018, 59) and promote both PCP and PPI (van Winden and Carvalho 2019). We propose that they may also fulfil diverse city needs. Whereas at the core of a contest is the idea of giving 'rewards for new inventions' (Williams 2012, 752), secondary goals were considered highly important in Tampere. Hackathons were understood to produce favourable spillovers by promoting the city's brand image and supporting economic activity, similar to previous studies' findings (Liotard and Revest 2018; Mergel and Desouza 2013). Hackathons were also thought to give business opportunities, especially to small companies, often at a disadvantage in public procurement (Karjalainen and Kemppainen 2008; Loader 2015). Similar to the organizer, the participants were also motivated by multiple factors. Besides the reward money, they sought contacts, future business opportunities, and an opportunity to learn.

The picture that the studied hackathons paints of innovation contests in the public sector goes beyond the transactional view of crowdsourcing where the interest is on solving a defined task in an effective way (Dahlander, Jeppesen, and Piezunka 2019). Instead, they may be viewed as 'conversations' – interactive processes where innovations are developed among people from different backgrounds and with different perspectives (Lester and Piore 2004; Rutten 2017; Uyarra et al. 2017). Following Lester and Piore (2004), public officers' essential tasks then become establishing contacts to interesting parties and initiating a conversation while contributing to it with novel ideas. Being relative lightweight to organize, innovation contests may promote conversations, especially between cities and startups (van Winden and Carvalho 2019). Cities have an opportunity to articulate their needs and wishes, and companies may showcase their abilities.

It has been argued that a majority of public procurements of innovation should focus on proximate policy goals instead of broader innovation policy goals (Uyarra and Flanagan 2010). For cities, this typically means prioritizing solutions that fulfil local needs. Facilitating interactions between local actors can benefit procurement by connecting people with different backgrounds and shaping interpretations of desired and feasible innovations (Edquist and Zabala-Iturriagagoitia 2012; Rutten 2017). Being more exciting and less bureaucratic than traditional procurement (cf. van Winden and Carvalho 2019), innovation contests may be useful by acquiring new perspectives to local problems. Consequently, contests may have lasting benefits, even if their direct outcomes are often modest (Carr and Lassiter 2017; Johnson and Robinson 2014; van Winden and Carvalho 2019).

Suppose innovation contests stress conversations over solving individual tasks. In that case, some of the organizing principles should be re-evaluated. Let us first consider the structure of a contest. To ensure connections to the participants, the city cannot

outsource interactions with them to intermediaries. In the Junction hackathon, interactions between the end-users and the participants were limited, and the contestants' profiles did not match the city's needs. The lack of social and spatial embeddedness restricted the outcomes to internal learning in lieu of generating lasting relationships and interactive learning, which are known to facilitate public procurement of innovation (Edquist and Zabala-Iturriagagoitia 2012). Moreover, in Enlighten Tampere, the winning solution had connections to multiple stakeholders within the city and strengthened their collaboration. Therefore, the hackathon facilitated also internal conversations among different groups with various interests, which has been recognized as a critical factor in taking advantage of emergent regional development paths (Sotarauta and Mustikkamäki 2012). Concerning size, whereas massive competitions with rewards in millions may be required for solving complex technological challenges (Adler 2011), smaller hackathons may help solve more straightforward and local problems (cf. van Winden and Carvalho 2019).

Related to defining the problem statement, we identified how multiple interests influenced the contests' goals and expectations at different organizational levels. The contests integrated the goals of multiple development projects and the city's strategic goals, which had different emphases. This multitude of secondary goals associated with innovation contests reflects the general trend of viewing public procurement as a strategic innovation policy tool (Edquist and Zabala-Iturriagagoitia 2012; Uyarra et al. 2020). It, however, clashes with the best practices of innovation contest design. It is argued that, in a contest, the problem statement should be crystal clear (Adamczyk, Bullinger, and Möslein 2012; Carr and Lassiter 2017; Mergel and Desouza 2013; Spradlin 2012), and that in the case of multiple goals, a contest should be split into a multitude of individual goals to ensure that the problems are sufficiently self-explanatory and straightforward (Blohm et al. 2018). Merging multiple distinct goals is likely to reduce the clarity of the problem statement and the contest's effectiveness in generating suitable solutions.

Our study produced a more nuanced understanding of the upsides and downsides of multiple goals. The findings support the concern that integrating multiple goals in a single contest may reduce its clarity as the contestants have less concrete ideas of what is expected of them. In both contests, the problem statements were defined at a relatively abstract level, which gives plenty of room for proposing innovative solutions but offers little guidance to specific directions for developing solutions. The findings suggest that this difficulty may be mitigated by ensuring effective interaction between the contestants and the organizers during the contest. Communication with the organizers enabled the gradual clarification of the problem during the process. In Junction, the organizers included even more people in the design phase to ensure the submissions' relevance and the end-users' commitment to implementing the solutions. Including more viewpoints may be a risk in terms of clarity but help contestants understand the city's needs and improve the organizer's ability to put the ideas that they receive into practice. Hence, there may exist a trade-off between clarity and implementability in innovation contests determined by the number of distinct viewpoints involved in contest design: acknowledging multiple viewpoints may help manage implementation-related risks but harm clarity. Furthermore, difficulties may arise if end-users are not involved throughout the process as project officers may lack the ability to engage in in-depth conversations as happened in Junction. This may harm the adaptation of participants'

solutions to local needs (Uyarra and Flanagan 2010), the selection of the best solutions (as in Junction), and the broader adoption of the solutions within the city (van Winden and Carvalho 2019).

Regarding motivation, previous studies emphasize the importance of identifying desired participants and understanding their incentives comprehensively (Liotard and Revest 2018; Mergel and Desouza 2013). Our findings support this notion. The Junction case provides an illustrative example of how poor knowledge of potential participants' profiles and restrictions may lead to a lack of interest in participating. Sometimes, especially when seeking more ambitious innovations, it may be beneficial to attract large and diverse crowds (Dahlander, Jeppesen, and Piezunka 2019). However, given the difficulties of solving large challenges with small-scale contests (van Winden and Carvalho 2019) and the fact that conversations often benefit from being connected to a place (Uyarra et al. 2017), it may be both efficient and feasible to target a defined set of actors. Local actors should be considered because they may be straightforward to identify, more receptive to reputational incentives, and easier to develop long-term relationships with, instead of one-off discussions (van Winden and Carvalho 2019).

Conclusions

In contrast to the typical view of innovation contests where the seekers and solvers operate separately, our findings suggest that cities may benefit from hackathons by engaging in conversations with participants: interactive processes to facilitate mutual learning and rich alignment of views of people with different perspectives. Hackathons may bring together actors for developing an understanding of local problems and potential solutions. This differs from contests that strictly prioritize the identification of new developers and technologies.

This research has some implications for practice. While we do not dispute the value of existing insights on the efficient design of innovation contests (Adamczyk, Bullinger, and Möslein 2012; Dahlander and Piezunka 2014; Desouza 2012), we emphasize that if secondary goals such as networking and brand benefits are considered important, special attention should be paid to interactions during the contests, the involvement of relevant viewpoints from the city organization, and acknowledging incentives other than monetary rewards. In such cases, a contest's success cannot be evaluated merely based on acquiring new ideas or innovations. Instead, more comprehensive benefits that may emerge over long periods of time need to be assessed.

Our study suggests value in involving various internal stakeholders in hackathons. We consider investigating the dynamics between temporary development projects and the broader city organization an exciting avenue for future research. On the one hand, there is the challenge of ensuring that the contests have a lasting impact. On the other hand, there lies an interest in examining how contests may facilitate cross-functional thinking and collaboration (Athanasaw 2003; Sotarauta and Mustikkamäki 2012).

While our study is limited by its empirical focus on smart city hackathons, we see a potential for examining how contextual factors such as a contest's domain and size influence its organization. Overall, the literature on innovation contests is scarce and scattered, and there is a need to combine insights from crowdsourcing, hackathons, public procurement, regional policy, and innovation policy, to understand their potential

and organization. We have taken a step in this direction, but more work is needed to understand the transferability of the findings from one context to another. We also welcome quantitative assessments of the relationships between contests' elements such as their structure, problem statement, and means to motivate participants, and their outcomes. In our study, we touched upon the participant's subjective motivations to participate in the contests. However, our data in this respect is limited: while we interviewed all key organizers, we did not extensively investigate the participants' viewpoints. As there is little experience in organizing innovation contests, we consider it important to give voice to the participants' experiences. Here, innovation contest researchers could learn from studies on crowdsourcing (e.g. Acar 2019; Zheng, Li, and Hou 2011).

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